

# Second Degree Price Discrimination of the Modern Payment Terminal Services

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### **Abstract**

This paper introduces price discrimination, especially second-degree price discrimination, and applies its theory in the context of modern payment terminal markets, where two service packages, one of iZettle's and the other of OP Kassa, are analyzed. Theory part deals with price discrimination through quantity-discount packages and two-part tariff, where as in the analysis part we apply the two-part tariff model. In both parts, in theory and analysis part, we found that second-degree price discrimination is a profitable tool for pricing.

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**Keywords** Pricing, Second-Degree Price Discrimination, Modern Payment Terminal Services

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## **1. Introduction**

Pricing is never ending subject and function, starting from simple and narrow point of view continuing with constant addition of variables, theories and angles from various disciplines. Pricing is also one of the core themes of economics. It has an great impact on firms profits through its affects on the levels of demand and the unit profits of sold products and services.

In this text, concentration will be on some what limited point of view of pricing. This is about price discrimination, mainly about the second degree price discrimination, and its analysis in the context of the modern payment terminal services. Opening the definition of the modern payment terminal services' happens in the beginning of the analysis part.

### **1.1 Definition of the Price Discrimination**

Fundamental definition of the price discrimination is that the same product is sold for different consumers at different prices. (H.R Varian 1989) Stigler (1987) goes further with the description of price discrimination: "price discrimination is present when two or more similar goods are sold at prices that are in different ratios to marginal costs." Stigler explains this through simple book sales example, where paperback book is sold for \$5 and hard cover for \$15. On his point of view those can be seen as the same product, because the type of the book cover doesn't explain the price difference, so there must be price discriminaton. This latter point of view takes in account more relativity as the former and also describes the roguish nature of pricing and price discrimination.

### **1.2 Review of the First- , Second- and Third-Degree Price Discrimination**

Price discrimination is commonly divided into three more or less different price discrimination theories. These theories are 1<sup>st</sup> , 2<sup>nd</sup> and 3<sup>rd</sup> degree price discrimination.

First-degree price discrimination is commonly thought as a very theoretical model, called also perfect price discrimination, because it is about setting the maximum price for the product, that one is willing to pay. (H.R Varian 1989) Imagine that in the supermaket the cashier magically knows every customers' maximum willingness to pay for a lollipop and due to that knowledge, she prices differently the lollipop for each customer. Broader review of first degree price discrimination is left out of this paper.

The second-degree price discrimination, known also as menu-pricing, is about creating a menu or offering of different packages with different price. When the menu or package offering is set, then the customer by itself selects the option that benefits her the most. One way of executing packaging is amount discounts, which means for example that a supermarket who sells pasta, would set three packages of pasta that includes different amount

of macaron and sets the price for these packages. Then in the supermarket, customer chooses from these three options, the one that suits her best. This price discrimination theory is core of this work.

The third-degree price discrimination reminds about the first-degree price discrimination. Where the optimal price setting for each person is conducted separately, whereas in the third degree price discrimination the optimal price is set for a specific group chosen by certain criterias. Very classic example of this is student discounts. This part of price discrimination theory is also left out of this paper.

## **2. Methodology**

### **2.1 Structure and goals**

This thesis is based on two main parts. The first is theory explanation and the second is analysis part. The theory part of the price discrimination is a literature review and its first goal is to describe and understand the basics of the second degree price discrimination. And the second goal is to show its opportunity to optimize pricing for increase in profits. Where as the goal of the analysis part is to describe the pricing in the modern payment terminal markets through the application of second degree price discrimination theory.

### **2.2 Models**

The core of the theory part is mathematical computation, two second degree pricing models and a graphical view of these models. Concentration of presenting these mathematical models will be some what shorted from the sources.

### **2.3 Analysis of the Modern Payment Terminal Services**

In the analysis part, two modern payment terminal service providers are chosen and the prices of these services are found from their websites and only certain service packages are chosen for simplicity of comparison.

### **3. Second-Degree Price Discrimination Theory**

This part starts with defining a few conditions generally for price discrimination, then concentration is on understanding further the second degree price discrimination from introduction part and finally two theories of second degree price discrimination is dealt through mathematical computation and graphical view. Presentation of quantity discounts are chosen, because it describes well the nature of second degree price discrimination and this review creates a great base for viewing the two-part tariff pricing strategy, that is relevant for the analysis part due to the current pricing decisions made by these modern payment terminal service firms. These firms has currently chosen the two-part tariff strategy for the packages chosen to the comparison.

#### **3.1 Conditions for Price Discrimination**

Varian argues in the Handbook of Industrial Organization that “Three conditions are necessary in order for price discrimination to be a viable solution to a firm’s pricing problem.” He writes that the firm must have some market power, ability to sort customers and also ability prevent sales.

Basic economics knowledge of competitive markets is that, if someone is trying to sell a product with higher price than the others, this firms product won’t be bought. So in order to be able to use price discrimination, the firm must have some market power to be able to price above the marginal cost. Furthermore, to know how to set right prices for different customers, the firm must be able to sort them. Varian uses examples of age and time for sorting. Carlton and Perloff (1994) have several examples of preventing the resale, which is Varian’s third condition. They discuss that some goods are not that easy to resell, because of their nature of the product. Services and electrical power are example of these kind of products. Also side costs such as taxes and transportation costs can be used as a factor that can prevent the resales. For example when the firm is selling products to different regions or countries.

#### **3.2 Two Types of Consumer**

Varian and also Gotlibovski and Kahana uses two types of consumers example to compute mathematical model of second-degree price discrimination. Their approach to mathematical presentation is a bit differently computed from each other and in this paper the Gotlibovski and Kahana’s presentation is used. The continuum of types example is presented in Varian’s text, but dealing with this will be left out of this paper.

Consider a situation where there is a profit-maximizing monopolist producing single product at constant marginal cost  $c$ . Then consider there is two types of heterogeneous consumers:

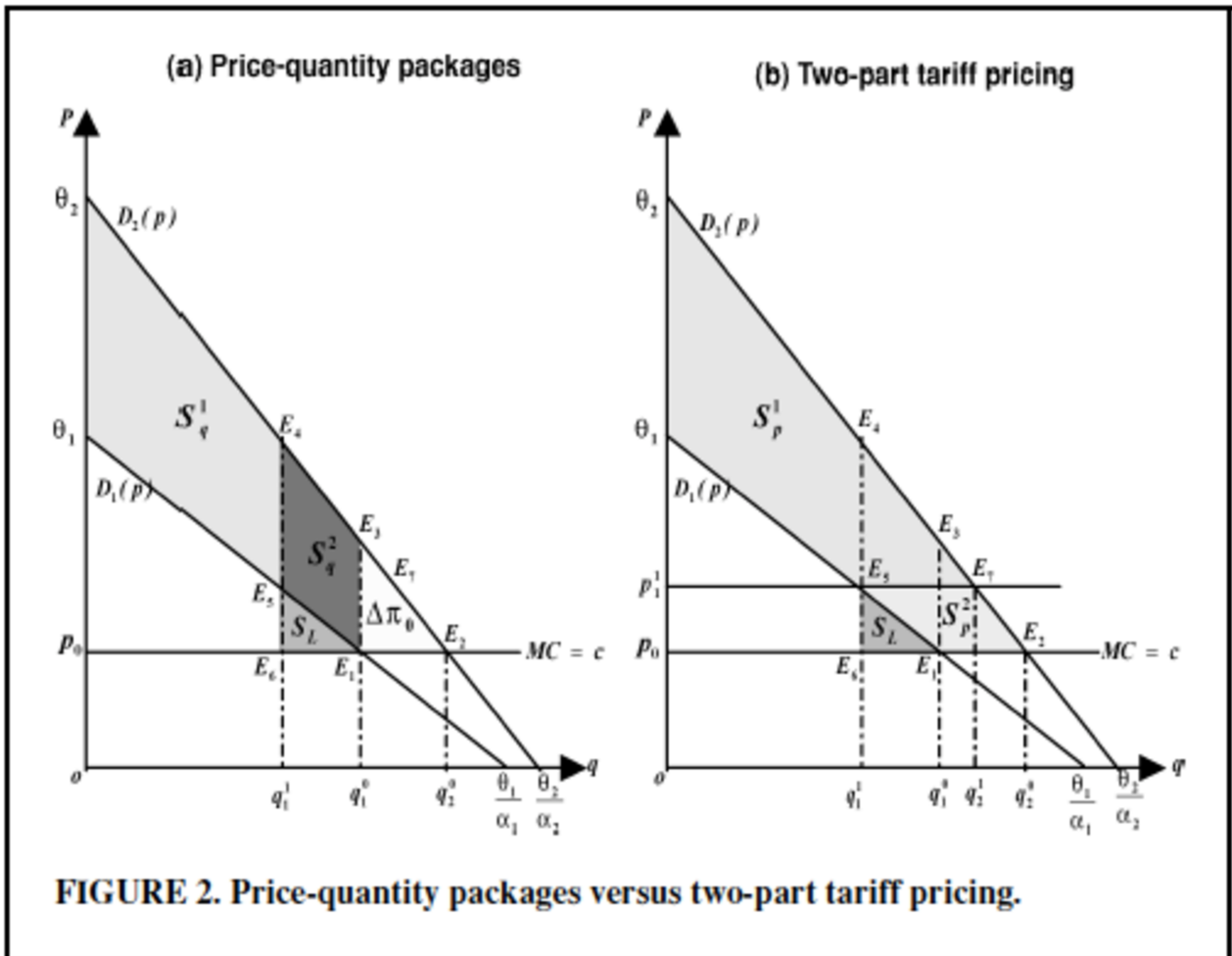
If the monopolist knows the preferences of each consumer, one of its optimal pricing strategies is to offer quantity packages and the other is to offer a discriminatory two-part tariff. In the first strategy packages for types 1 and 2 quantities are  $q_1^0 = D_1(c)$  and  $q_2^0 = D_2(c)$ .  $GS_i(q_i^0)$  are the areas of  $A_1 + A_2$  for  $i=1$ , and  $A_1 + A_2 + B_1 + B_2$  for  $i=2$  in Figure 1. Similar results will be found, when offering consumers two-part tariff, but now the pricing model is build from the marginal price equal to the marginal cost  $c$  plus sum fee, that extract all consumers' net surpluses shown in figure 1 as areas  $A_1$  and  $A_1 + B_1$ . These are the optimal pricing strategies where producer gains all the consumer surpluses.





### 3.2.1 Price-Quantity Packages

Assume now that the monopolist doesn't have the ability to observe the consumer type and given that, it can't allocate the package 1 for type 1 and package 2 for type 2. This would end up to situation, where both types would buy the package 1, because now type 2 would gain consumer surplus from the package 1 described in figure 2a. Now it can be seen that neither of these two versions of price discrimination strategies are optimal.



**FIGURE 2. Price-quantity packages versus two-part tariff pricing.**

The monopolist can increase profits by offering a package of size  $q_2^0$  targeted at the higher demand type, by subtracting the full discrimination price  $A_1 + A_2 + B_1 + B_2$  by the area of  $S_q^1 + S_q^2$ , which describes the benefit type 2 would have gotten, if he would have chosen  $q_1^0$ . This will lead to monopolist's profit increase by the area of  $\Delta\pi_0$  in figure 2a. Further increase in profits can be achieved through decrease in the type 1's package size and demanding the price that leaves no consumer surplus for him. Although this will reduce the profit from the

type 1 by  $S_L$ , but it will also decrease the package 1 interest for the high demand type by the area of  $S_q^2$ . This also meaning that now the monopolist can increase the price charged for  $q_2^0$  by  $S_q^2$  and as long as  $S_q^2$  is more than  $S_L$ , the monopolist's profit is increased. Next step is to reduce the amount targeted at type 1 so that it just equals the amount gained from type 2.

As mentioned, when setting the price for type 2, it has to be taken in account that this type could fake and try to be type 1 so taking it in account, type 2 faking is given by  $GS_2(q_1) - GS_1(q_1)$ .

Type 2 can be charged by the monopolist for the package of size  $q_2^0$  by type 2's willingness to pay minus his surplus from faking to be type 1 consumer:  $GS_2(q_2^0) - (GS_2(q_1) - GS_1(q_1))$

Where as the monopolist's profit as a function of  $q_1$  is:

$$\pi(q_1) = GS_1(q_1) + GS_2(q_2^0) - (GS_2(q_1) - GS_1(q_1)) - c(q_1 + q_2^0)$$

And the first-order condition for maximation of  $\pi$  is

$$\frac{d\pi}{dq_1} = 0$$

Later in the analysis phase of modern payment terminal services, we find that there are also quality differences included in pricing. Maskin and Riley (1984) where first to prove that this quantity based discrimination model is also applicable for price discrimination by quality. Further explanation of proving and representing this applicability is left outside of this work.

### 3.2.2 Two-Part Tariffs

“A two-part tariff is one in which the consumer pays a lump-sum fee for the right to buy a product, in addition to an ongoing fee for its actual use” Gotlibovski and Kahana (2010). A few examples of the two-part tariffs that Gotlibovski & Kahana uses are taxi payment, where taxis have a starting fee and per-kilometer charge, and telephone services, which has monthly charge and air-time based cost.

They highlight, that for the two-part tariffs, there must be prevention of resale so that the payer of the lump-sum fee can't purchase large amounts of the product and resale to other consumers.

Now continuing the Gotlibovski's & Kahana's described price discrimination model creation from caption 3.2, where we saw that if the monopolist knows the consumer types, it can choose optimal marginal cost plus lump-sum fee for the different types. As in the example of quantity discounts, also in two-part tariffs type 2 consumer can pretend to be type 1. Given

that, the pricing model where the monopolist has perfect price discrimination based pricing, isn't anymore optimal for the monopolist.

However, it is still optimal for the monopolist to set the consumer type 2 marginal price to  $c$ , but the lump-sum fee can't no longer be the whole net consumer surplus. The basic idea of setting the lump-sum fee for type 2 is, that the two-part tariff meant for type 1 becomes less and less attractive to him and then the slump-sum fee can be increased for type 2.

The monopolist is able to reduce type 2's attractiveness from the targeted two-part tariff for type 1 by increasing the marginal price for type 1 from  $c$  to  $p_1^1$  in figure 2b and also decreasing the type 2's lump-sum fee exactly to its new net surplus (see the triangle  $p_1^1 E_5 \theta_1$  in figure 2b). This pricing action decreases type 2's outcome from faking to be type 1 by trapezoid  $S_p^2$  in figure 2b. Furthermore, the slump-sum fee for type 2 has to be lower by  $S_p^1$  than type 2's net surplus at price  $c$ . While the decrease of type 1 two-part tariff marginal price decreased the monopolist profits, at the same time it increased the profit from the type 2 by  $S_p^2$  and as long as  $S_p^2$  is greater than  $S_L$ , the profit for monopolist increases. The type's 1 marginal price is decreased as long as the type 2 increase of the profit is equal to the loss of decrease of the type 1 price.

Now the computation of optimal two-part tariff can be computed:  $p_1$  is the marginal and net surplus  $NS_1(p_1)$  is the function of lump-sum fee for the consumer 1. So the surplus for consumer 2 from faking to be consumer 1 is  $NS_2(p_1) - NS_1(p_1) = S_p^1(p_1)$ . Given this, consumer 2 can be charged by marginal price  $c = NS_2(c) - S_p^1(p_1)$  in addition to the targeted lump-sum fee.

This would mean that the price would be constructed from the area of marginal cost and slump-sum fee, that is for consumer 1 the area of  $p_1^1 E_5 q_1^1 0$  and  $p_1^1 E_5 \theta_1$  and for the consumer 2 the area of  $p_0 E_2 q_2^0 0$  and  $E_5 E_7 E_2 E_1$ .

Next step is to set the profit function  $\pi(p_1)$  and the first-order for maximization of  $\pi$  is  $\pi(p_1^*)$ . Further creation of these phases can be seen in Gotlibovski & Kahana (2009).

### 3.2.3 Profit Comparison

According to Gotlibovski & Kahana, if monopolist can't recognize which consumer is which, the price quantity comes always first in profits compared to two-part tariffs. In their writing, one example shows that quantity discounts' beats two-part tariffs in profits by 6% and in another example nearly by 3%. In addition, while calculating and comparing these price models, there has to be taken in account, that it might be profitable to serve only the higher demand type consumer.

The narrow presentation of the profit differences between the quantity discount and two-part tariff model was left outside of this paper, because the goal and concentration in this text was chosen for understanding these models for simple analysis purposes in the Modern Terminal Services part. Further understanding of the reasons of higher profits of quantity discount is recommended for broader analysis of optimal prices of these services. Especially when using quality instead of quantity.

## **4. Pricing Analysis of the Modern Payment Terminal Services**

In this analysis part we start from describing these services and then defining a few conditions, which then offers the scope in what we are conducting the analysis. In this text, payment terminal services mean that there is a device, that can be used for card payments, payment terminal, this service also includes a display. This service has also an operating system. In addition to this definition of classical payment terminals, by modern terminal services we concentrate on the services, that include payment terminals, which has wireless usage capabilities and has high mobility features. Also the display and its usage is working remotely and in our later examples all those payment terminals, and these operating systems, runs on tablets. Also prices, onboarding process for accepting card payments and delivery time of devices are designed to quick access of accepting card payments. Also ease without complicated contracts and time taking introduction need to payment terminals and operating systems, as these merchants are more or less familiar with usage of tablets.

### **4.1 Conditions for the Analysis of the Modern Payment Terminal Services**

First condition for the analysis is that we are restricting the quality variation of different service providers' packages, by analysing only service packages that includes payment terminal and the software for its usage by tablets, but these tablets won't be included in the package nor cash registers or receipt printers. There are also quality variables such as delivery time of the service, opening hours of the customer service and also service agreement levels, which are left out of the comparison. Also possible differences in software for controlling the payment terminal on tablets, will be let outside of the analysis. Many of these service providers also provides extra services, for example financing, or has integration capabilities such as e-commers cooperation and automatisated book keeping. These extra features won't be also included in the price comparison. The analysis are also restricted to two actors in the field, because that provides best application of the above mentioned two customer type pricing examples. These service providers are iZettle and OP Kassa. PayPal's recent acquisition of iZettle for 2.2 billion USD, describes shortly the market of these kind of services.

### **4.2 Description of iZettle's and OP Kassa's current pricing**

Given these restrictions for analysis of these modern payment terminal services' pricing in the perspective of price discrimination, we can now start describing the nature of the pricing models used for these services. In the table 1, is shown prices for iZettle and OP Kassa.

Service provider	Slump-sum fee	Transaction cost
iZettle Go	€19,00	1,95%
OP Kassa Startti	€79,00	2,50%

Table 1

As seen on the table, OP Kassa Startti is more expensive with all the positive card payment volumes merchants receives. To be able to compare these two packages, we define by random the yearly amount of card payments for these two types that has different level of card payments per year. The type 1, which is the lower type, has worth of 5000 € card payments per year and the type 2, the higher type, has worth of 50 000€ per year. By assuming this we only know the amount of  $Q$  for demand  $Q(P)$  function, but we don't know the demand function and we are looking the  $Q$  only at one point.

Defining the demand function, or quessing it, will be left for suggestions to future research. To form the two type second-degree price discrimination two-part tariff model for comparison of these three packages, we also need marginal cost  $c$  for comparison.

Merchants' marginal cost in reality is constructred from transaction fees and device costs such as payment terminal and tablet, but at this comparison we take it as constant. Even though transaction cost is volume based. There also may be big differences in that cost for service providers, for example if the service provider is producing part or most parts of the transaction card payment activities by itself. For that reason it wouldn't have to pay so much margins to another party or parties. Also such factors as retention rate and acquisition cost will be left outside of this analysis.

In the package comparison, we put these two packages on the line and see how they do with these two consumer types. We think these packages as they would be packages of one service provider, so that we can have a look on them as a one menu-price setting. Given the prices in the table 1 and assumptions created above, we get the profits for each package and we see in the table 2 that with these two packages, iZettle will be chosen by both of customer types. This means that the OP Kassa package price has been designed badly, because it won't be chosen for the more expensive price.

Transaction volume of type $i$ (€)	Cost of iZettle	Cost of OP Kassa
Type 1 - 5000	€116,50	€204,00
Type 2 - 50000	€994,00	€1 329,00

Table 2

### 4.3 Application of the Two Customer Type Model

Now we think about these packages as they would be packages of one service provider, because that allows us to understand how menu-pricing works with these two packages. And before we are thinking about changes in current pricing, we've to deal with one critical missing factor, the demand curve, which restricts the maximum price the merchant is willing to pay for each transaction volume. Despite the knowledge of the missing demand curve, we'll continue with the limited knowledge and again leaving demand curve review part for the further research, because it won't be limitation for the review of changing these prices a little, especially in the purpose of pointing the optimal menu-price creation. Also we are supposing these prices won't be already above the demand curve, because these products knowingly sells in the markets.

We start thinking about the price change from the table 2 and from the wanted outcome change, what would be that the both types wouldn't by the same package, so that the "one service provider" would make more profit by the price changes. We would like to change at the same time iZettle's and OP Kassa's price so that the type 2 cost change for example for iZettle would increase above OP Kassa's price while this OP Kassa package price is somewhat lowered at the same time and also keep iZettle's type 1's price still lower than type 1's OP Kassa price. For example if we change iZettle's lumps-um fee from 19 euros to 49 euros and remaining the transaction as it was and then lowering OP Kassa's transaction fee from 2,5% to 1,80% (Price changes in the table 3), we see in the table 4 that type 1 would still prefer iZettle, but type 2 would now rather choose OP Kassa before iZettle.

Service provider	Slump-sum fee	Transaction cost
iZettle	€49,00	1,95%
OP Kassa	€99,00	1,80%

Table 3

Transaction volume of type i (€)	iZettle	OP Kassa
Type 1 - 5000	<b>€146,50</b>	€189,00
Type 2 - 50000	€1 024,00	<b>€999,00</b>

Table 4

In the original version (Table 2) type 1 + type 2 profit,  $116,50\text{€} + 994\text{€}$ , was  $1\,110,5\text{€}$  and now with the new pricing (Table 4)  $146,50\text{€} + 999,00\text{€} = 1\,170,50\text{€}$ , which is exactly 60 euros more than the profit in the first version of the pricing. In percents, the change increased 5,4% the original price.

Now if we look at back at the table 1 and think about these packages again separately for two different service providers, we noticed that for the both types, iZettle's package was more preferable to OP Kassa's pricing. If OP Kassa would like to make the pricing more favorable, it would have to lower its prices, but then the question is, is it worth it to try to chase both of the types or just the other. That could depend on the amount of types 1 and 2 in the market, if lowering the price so that the type 2 price times amount of the 2 type merchants would make merchants choose OP Kassa's package over iZettle's and at the same time lower profit more than the gain of the type 1 price times amount of type 1 merchants, OP Kassa should serve only type 2 merchants. Analysis of further actions of price setting of the service providers, could offer interesting outcomes.



## **5. Conclusions and Future Research Suggestions**

### **5.1 Conclusions**

We started understanding generally the concept of price discrimination and the menu pricing, which was our first goal. We also achieved the second goal, which was to present the gain in profits through menu-pricing actions. It was pointed in both parts, in the theory and analysis part, that the second-degree price discrimination can be a profitable tool. The third goal was to describe the nature of the iZettle's and OP Kassa's pricing for the packages chosen for analysis and also to apply second-degree model in practice. In the application phase, we found that a little restructure of prices of the service packages lead to our profit change of 60 euros, which was 5,4% increase to original price.

### **5.2 Future Research Suggestions**

We faced the lack of demand curve estimation in the analysis part and concentrating on creating the demand curves for these two different types, would be my future research suggestions to achieve more comprehensive and usable analysis of the affects for profits from different changes in menu-pricing. I also suggest to include quantity package proposals while taking in account quality differences between products, because analysis in this text where very limited and taking quality differences more widely in account, would offer more realistic outcomes. Furthermore, using models of game theory, could offer useful tools for analysis of pricing decisions and equilibrium prices.

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